A.D. 1870, 11*th April.* **N° 1061.**

SPECIFICATION

OF

THOMAS JAMES SMITH.

TREATING SEWAGE, &c.

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Treating Sewage, &c.

LETTERS PATENT to Thomas James Smith, of the Firm of Robertson, Brooman, and Company, of 166, Fleet Street, in the City of London, Patent Agents, for the Invention of "IMPROVEMENTS IN TREATING EXCREMENTAL MATTERS."—A communication from abroad by Cyprien Marie Tessié du Motay, of Paris, France, Chemist.

Sealed the 4th October 1870, and dated the 11th April 1870.

PROVISIONAL SPECIFICATION left by the said Thomas James Smith at the Office of the Commissioners of Patents, with his Petition, on the 11th April 1870.

I, THOMAS JAMES SMITH, of the Firm of Robertson, Brooman, and Company, of 166, Fleet Street, in the City of London, Patent Agents, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN TREATING EXCREMENTAL MATTERS," to be as follows:—

This Invention consists in a new mode or treatment in order to reduce to the insoluble state, in the form of fertilizing matter, all the soluble substances contained in human and animal excrement, and to separate thus, by means of precipitation, the liquids with which they are combined or mixed. Taking human or animal excrement the Inventor disinfects it by one of the metallic salts or antiseptic agents which are now employed when it contains ammonia in the state of sulpho-hydrates, or sulphurets, or sulphuretted hydrogen in the free state. After this operation he adds to the mixture of solids with liquids, or separately or united in one and the same liquor, soluble phosphates, acid or neutral, magnesian salts, fluo-silicic acid, or even soluble fluo-silicates, alkalino terrous, or metallic, such as fluo-silicates of lime, of magnesia, of alumina, or of iron, and the like. When these reagents separatively or collectively employed have reacted upon the soluble portion of the excremental matters in such a manner as to form a combination with them the Inventor adds, in order to cause them to pass from the acid into the neutral or alkaline state, either lime or carbonate of lime, or magnesia or carbonate of magnesia. If after this treatment the excrement still gives off sulpho-hydric odours a metallic salt should be added in order to complete its disinfection.

The above reactions are explained as follows:—The acid or neutral phosphates added to the fœcal matters take hold of the ammonia; the magnesian salts thus decomposed then form double phosphates of ammonia and magnesia, whilst the fluo-silicic acid or the fluo-silicates react upon the alkaline salts of potass and soda and precipitate them in an insoluble state. The lime, the carbonate of lime, the magnesia, or the carbonate of magnesia neutralize the liquors which have remained acid until then and effect the precipitation of the ammoniaco-magnesian phosphate, which as is well known only precipitates in neutral or alkaline liquors. Of all the fluo-silicates above named the Inventor prefers to employ the fluo-silicate of alumina, because it has the property of aiding the deposit of the matters held in suspension, for in this case it is transformed partly into chloride of aluminium which is itself also decomposed by water into oxychloride of aluminium and alumina. This alumina in precipitating into the gelatinous state draws with it the animal or vegetable matters held in suspension in the excremental liquors. The fluo-silicate of alumina acts therefore not only as a precipitate of alkaline salts but also as a mechanical agent. Whence it will be seen that this reagent should be employed in preference to all others when treating excremental and dungy matters as well as sewage. When after a certain time of repose the solid excremental matters are separated from the liquid, the latter still contain urea, a substance which it is necessary to transform into compounds capable of becoming soluble in the form of fertilising matters. For this purpose the Inventor either separates the solid from the liquid matters or leaves them in contact, and he adds a liquid containing a solution of free baryta or salt of baryta. It also precipitates cyanurate of baryta and it leaves in the liquid medium either ammonia or ammoniacal salts.

The Inventor has always perceived that the quantity of cyanurate precipitated being a very small fraction of the proportional quantity of ammonia engendered in the liquor by the splitting up action of the baryta, whence it becomes probable that by the reaction of this base it produces all at once cyanurate and cyanate which is ulteriorly decomposed into carbonate of baryta and ammonia. In order to render the free ammonia or that which is contained in the salts insoluble he employs then either an acid phosphate or a neutral soluble phosphate and a salt of magnesia. It precipitates into a double phosphate of ammonia and magnesia. In order to produce this last reaction if the Inventor uses chloride of barium in excess, he employs sulphate of magnesia, which precipitates into the state of insoluble sulphate of baryta, the baryta of the chlorine. If he makes use of sulphuret of barium he preferably employs instead of the sulphate of magnesia, sulphate of iron, which by producing the same reaction takes up the sulphur from the sulphuret of barium, passing into the state of sulphuret of iron. When the cyanurate of baryta is held in the insoluble state in solid excrement, it passes ulteriorly into the soil in the condition of fertilizing matters transforming into carbonate of ammonia. When, on the contrary, it is precipitated in the middle of the liquids previously separated from the fœcal matters it is collected either by decantation or filtration. In this state it is dried and then heated until complete decomposition ensues, for under the action of heat it rapidly becomes transformed into carbonate of ammonia and carbonate of baryta. The ammonia collected in the mineral acids combines with them in the state of fixed salts suitable for the purposes of manufacture and agriculture. The carbonate of baryta remaining dissolved may be employed to generate chlorides of barium, which are suitable for decomposing the urea of fœcal matters.

The Inventor has also remarked that the transformation of urea into ammonia or ammoniacal salts, which will precipitate into the state of ammoniaco-magnesian phosphate, may be effected by the double reaction of the fluo-silicic acid, or of the acid fluo-silicates employed alone or mixed with other acids and alkaline or alkalino-terrous bases, employed in excess all at once, in order to saturate the free acids and to disengage the ammonia from the liquors containing the decomposed ureas.

The Inventor has ascertained, lastly, that the lime dissolved in different saccharine compounds, such as sugar, molasses, and glucose, will act like baryta in transforming the urea contained in sluices, sewers, or urinals, into ammonia equally transformable into ammoniaco-magnesian phosphate.

It will be seen from what precedes that the object of the present Invention, viz., the precipitation into the soluble state in the form of fertilizing matters of all the soluble substances contained in human and animal excrement has been completely attained.

The characteristic features of this Invention are as follows :—

1st. The separate or simultaneous employment of a series of re-agents comprising soluble acid or neutral phosphates, magnesian salts, fluo-silicic acid, and fluo-silicates.

Secondly. The employment of alkalino-terrous bases.

Thirdly. The employment of fluo-silicate of alumina as a mechanical agent for the precipitation of organic or mineral substances other than the fœcal matters, the whole in order to precipitate to the insoluble state all the matters contained in the excrement, urea excepted.

Fourthly. The employment of baryta or its salts, in order to split up the urea into insoluble cyanurate and ammonia or ammoniacal salts.

Fifthly. The precipitation of this free or combined ammonia into the insoluble state in the form of ammoniaco-magnesian phosphate.

Sixthly. The alternate employment of fluo-silicic acid or acid fluo-silicates, and of alkaline or alkalino-terrous bases, in order to decompose the urea from sluices, sewers, or urinals, and to transform the decomposed urea into ammonia which will precipitate into the state of ammoniaco-magnesian phosphate.

And, seventhly. The employment of lime rendered soluble in saccharine matters to replace the baryta in order to produce the same effect as the latter.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Thomas James Smith in the Great Seal Patent Office on the 11th October 1870.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, Thomas James Smith, of the Firm of Robertson, Brooman, and Company, of 166, Fleet Street, in the City of London, Patent Agents, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Eleventh day of April, in the year of our Lord One thousand eight hundred and seventy, in the thirty-third year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Thomas James Smith Her special licence that I, the said Thomas James Smith, my executors, administrators, and assigns, or such others as I, the said Thomas James Smith, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "Improvements in Treating Excremental Matters," (communicated to me from abroad by Cyprien Marie Tessié du Motay, of Paris, France, Chemist), upon the condition (amongst others) that I, the said Thomas James Smith, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Thomas James Smith, do hereby declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:—

This Invention consists in a new mode of treatment in order to reduce to the insoluble state, in the form of fertilizing matter, all the soluble substances contained in human and animal excrement, and to separate thus, by means of precipitation, the liquids with which they are combined or mixed. Taking human or animal excrement, the Inventor disinfects it by one of the metallic salts or antiseptic agents which are now employed when it contains ammonia in the state of sulpho-hydrates or sulphurets, or sulphuretted hydrogen in the free state. After this operation he adds to the mixture of solids with liquids, or separately, or united in one and the same liquor, soluble phosphates, acid or neutral, magnesian salts, fluo-silicic acid, or even soluble fluo-silicates, alkalino-terrous or metallic, such as fluo-silicates of lime, of magnesia, of alumina, or of iron and the like. When these reagents, separately or collectively employed have reacted upon the soluble portion of the excremental matters in such a manner as to form a combination with them, the Inventor adds, in order to cause them to pass from the acid into the neutral or alkaline state, either lime or carbonate of lime or magnesia, or carbonate of magnesia. If after this treatment the excrement still gives off sulpho-hydric odours, a metallic salt should be added in order to complete its disinfection.

The above reactions are explained as follows:—The acid or neutral phosphates added to the fœcal matters take hold of the ammonia; the magnesian salts thus decomposed then form double phosphates of ammonia and magnesia, whilst the fluo-silicic acid or the fluo-silicates react upon the alkaline salts of potass and soda, and precipitate them in an insoluble state. The lime, the carbonate of lime, the magnesia, or the carbonate of magnesia neutralize the liquors which have remained acid until then and effect the precipitation of the ammoniaco-magnesian phosphate, which, as is well known, only precipitates in neutral or alkaline liquors.

Of all the fluo-silicates above named the Inventor prefers to employ the fluo-silicate of alumina, because it has the property of aiding the deposit of the matters held in suspension, for in this case it is transformed partly into chloride of aluminium, which is itself also decomposed by water into oxychloride of aluminium and alumina. This alumina in precipitating into the gelatinous state draws with it the animal or vegetable matters held in suspension in the excremental liquors. The fluo-silicate of alumina acts therefore not only as a precipitate of alkaline salts but also as a mechanical agent. Whence it will be seen that this reagent should be employed in preference to all others when treating excremental and dungy matters as well as sewage.

Therefore this method of treating excremental matters has for its object, first, to precipitate in an insoluble state all solid matters contained in sewerage or other impure waters; secondly, to transform the free or combined ammonia contained in these waters, also in an insoluble state in the form of ammoniaco-magnesian phosphate.

In the employment of this process it happens that after precipitation, the solid excremental matters are mixed with the ammoniaco-magnesian phosphate, which thus cannot be separated or isolated in order to be employed in the state of salt. It is necessary, therefore, to effect the separation of the ammoniaco-magnesian phosphate from the solid matters other than this salt. In order to accomplish this object the Inventor digests the mixture of solid excremental matters with the ammoniaco-magnesian phosphate, either in water charged with carbonic acid or in any other vegetable or mineral acid. The phosphate being soluble in dilute acid, while the particles of solid excrement are but slightly so or not at all, the Inventor isolates it in these liquid acids in which it dissolves. When the ammoniaco-magnesian phosphate is thus separated from all foreign solid particles he re-precipitate it by saturating it with magnesia, or the carbonate of this base, or with dolomy (dolomie), or a mixture of lime and magnesia. The precipitate thus obtained is the ammoniaco-magnesian phosphate in a saline state.

As in very diluted liquors the ammoniaco-magnesian phosphate is slightly soluble, and very little or not at all so in an aqueous liquor, so diluted as to contain alkaline basic phosphates. The Inventor adds, in order to complete the precipitation of the ammoniaco-magnesian phosphate, a certain quantity of alkaline basic phosphates.

The characteristic features of this Invention are therefore the following:—

First. The separate or simultaneous employment of a series of reagents, comprising soluble acid or neutral phosphates, magnesian salts, fluo-silicic acid, and fluo-silicates.

Secondly. The employment of alkalino-terrous bases.

Thirdly. The employment of fluo-silicate of alumina as a mechanical agent for the precipitation of organic and mineral substances other than the fœcal matters. All the above being employed in order to precipitate it into the soluble state all the matters contained in the excrement under treatment.

And, fourthly. The employment of dilute acids, followed by an addition of magnesia, of a carbonate of magnesia or of dolomy, (dolomie), or of a mixture of lime and magnesia, in order to completely separate the ammoniaco-magnesian phosphate from the solid particles of foreign matter.

In witness whereof, I, the said Thomas James Smith, have hereunto set my hand and seal, this Eleventh day of October, in the year of our Lord One thousand eight hundred and seventy.

T. J. SMITH. (L.S.)

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